इंटरनेट मानक

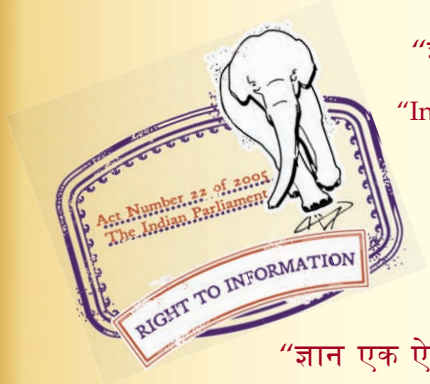
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 8290 (1976): General Purpose Audio Frequency Output Power Meters [LITD 8: Electronic Measuring Instruments, Systems and Accessories]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

IS : 8290 - 1976

(Reaffirmed 2000)

Indian Standard

SPECIFICATION FOR GENERAL PURPOSE AUDIO FREQUENCY OUTPUT POWER METERS

UDC 621·317·78·029·4

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 1977

Indian Standard

SPECIFICATION FOR GENERAL PURPOSE AUDIO FREQUENCY OUTPUT POWER METERS

Electronic Equipment Sectional Committee, LTDC 4

Chairman	*Representing*
SHRI S. N. MITRA	All India Radio, New Delhi
Members	
RESEARCH ENGINEER, ALL INDIA RADIO (*Alternate* to Shri S. N. Mitra)	
ASSISTANT DIRECTOR, ELECTRICAL ENGINEERING (DESIGN)	Naval Headquarters
ASSISTANT DIRECTOR, ELECTRICAL ENGINEERING (MATERIAL) (*Alternate*)	
SHRI H. K. L. ARORA	All India Radio and Electronics Association, Bombay
SHRI R. G. KESWANI (*Alternate* I) (Bombay)	
SHRI A. K. GHOSH (*Alternate* II)	
SHRI H. V. BADRINATH	Wireless Planning and Co-ordination Wing (Ministry of Communications)
SHRI A. M. JOSHI (*Alternate*)	
BRIG N. DAYAL	Directorate General of Inspection (DGI), Ministry of Defence
COL N KUMAR (*Alternate*)	
DEPUTY DIRECTOR GENERAL DIRECTOR (*Alternate*) (New Delhi)	Overseas Communications Service, Bombay
SHRI S K. DUTTA	Bharat Electronics Ltd, Bangalore
SHRI S. STEPHEN (*Alternate* I)	
SHRI G. S. CHANDRASEKHAR (*Alternate* II)	
SHRI N. GANESAN	All India Instrument Manufacturers' and Dealers' Association, Bombay
SHRI V. K. VASUDEVAN (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI B. P. GHOSH	National Test House, Calcutta
JOINT DIRECTOR STANDARDS (S & T)-I	Railway Board, New Delhi
JOINT DIRECTOR STANDARDS (S & T)-II (*Alternate*)	
SHRI R. S. KALE	Police Wireless (Ministry of Home Affairs)
WG CDR J. S. LAMBA	Directorate of Technical Development and Production (Air) (Ministry of Defence)
SHRI A. V. RAJU, SSO II (*Alternate*)	
SHRI M. S. S. MURTHY	Bharat Heavy Electricals Ltd, Bhopal
SHRI S. K. RAIZADA (*Alternate* I)	
SHRI S. P. DESHPANDE (*Alternate* II)	
SHRI Y. P. MADAN (*Alternate* III)	
SHRI S. C. MAJUMDAR	Radio Receivers Subcommittee, LTDC 4 : 1, ISI
SHRI S. P. PURI	National Physical Laboratory (CSIR), New Delhi
SHRI V. RAMA SUBRAMANYAM	Directorate General of Civil Aviation, New Delhi
SHRI K. N. RAMASWAMY	Directorate General of Technical Development, New Delhi
SHRI B. BHANOT (*Alternate*)	
SHRI C. S. RANGAN	Electronic Measuring Equipment Subcommittee, LTDC 4 : 2, ISI
SHRI G. R. S. RAO	The Radio Electronic & Television Manufacturers' Association (RETMA), Bombay
DR M. R. RAO	Panel for Interference Devices, LTDC 4/P 1, ISI
SHRI D. K. SACHDEV	Indian Telephone Industries Ltd, Bangalore
SHRI N. S. SATHYANARAYANAN (*Alternate*)	
SHRI M. SANKARALINGAM	Directorate General of Supplies & Disposals (Inspection Wing)
SHRI P T. KRISHNAMACHAR (*Alternate*)	
SHRI R. L. SETHI	Radio Transmitters Subcommittee, LTDC 4 : 4, ISI
DR Y. V. SOMAYAJULU	The Test and Evaluation Centre (NPL), New Delhi
SHRI P. SARYANARAYANA (*Alternate*)	
SHRI N. SRINIVASAN, Director (Electronics)	Director General, ISI (*Ex-officio Member*)

Secretaries

SHRI P. N. AMLEKAR
Assistant Director (Electronics), ISI

SHRI S. C GUPTA
Assistant Director (Electronics), ISI

(*Continued on page* 21)

Indian Standard

SPECIFICATION FOR GENERAL PURPOSE AUDIO FREQUENCY OUTPUT POWER METERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 16 November 1976, after the draft finalized by the Electronic Equipment Sectional Committee had been approved by the Electronics and Telecommunications Division Council.

0.2 Audio frequency output power meters are versatile measuring instruments used for the measurement of power of any system incorporating audio frequency amplifier. This instrument is particularly used for manufacture and servicing radio receivers, audio equipment, etc. The AF output power meter covered by this standard is a passive type of instrument and contains load resistors (across which the power is dissipated), of a variable nature to make the instrument suitable for wide ranges of impedances. The power is indicated on a meter either in watts (decimal, multiples or submultiples of 10) or in dB.

0.3 The output power meter is widely used as testing instrument in electronic, engineering and allied fields. In view of rapid expansion of electronic industry in the country, the demand of such instruments has been on the increase. The need, therefore, has been felt to laying down minimum requirements of such instruments which would serve as a guide to the manufacturers and users.

0.4 This standard is one of a series of Indian Standards on electronic measuring equipment. Other standards published so far in the series are given on page 22.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the requirements and methods of tests on general purpose audio frequency output power meters.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 General

2.1.1 *Magnitude of Sinusoidal Voltages and Currents* — shall mean RMS values unless otherwise specified.

2.1.2 *Audio Frequency Output Power Meter* — A device used for measuring the audio frequency power.

2.1.3 *Settling Time* — The time taken by the moving element of the output power meter to come to its equilibrium position, within a specified tolerance, when a power of constant value is applied between the input terminals under specified conditions.

2.2 Ratings

2.2.1 *Rated Power* — Value (or one of the values) of the output power measured by the output power meter and assigned by the manufacturer at or below which the power meter purports to comply with the standard.

2.2.2 *Rating* — The value of the output power which corresponds to the upper limit of the effective range.

2.3 Constructional Parts

2.3.1 *Index (Pointer)* — The means which indicate the position of the moving part of the instrument.

2.3.2 *Scale* — A series of markings and numbers on the dial from which the value of the power measured is obtained.

2.3.3 *Dial* — The surface which carries the scale and numbers.

2.3.4 *Scale Marks* — The marks which enable the position of the moving element of the instrument to be identified.

2.3.5 *Scale Division* — Interval between two consecutive scale marks.

2.3.6 *Total Scale Length* — The length of the arc (or the segment of a straight line) passing through the centre of the shortest markings on the scale.

2.3.7 *Effective Range* — That part of the scale where measurements can be made with the stated accuracy.

2.3.8 *Input Terminals* — Connection points of the instrument between which the power to be measured is applied.

2.4 Accuracy, Error and Variation in Indication

2.4.1 *Accuracy* — The accuracy of audio frequency output power meter is defined by the limits of intrinsic error and limits of variation in indication due to influence quantities.

2.4.2 *Accuracy Class* — Accuracy class is a classification of measuring instruments (or their accessories) the accuracy of which may be designated by the same number, this being the upper limit of error when the output power meter is used under reference conditions. The designating number is termed the class index.

NOTE — Since in this standard, the limits of variations and the intrinsic error are both dependent on the class index, the above definition should be considered as being applicable to the variations in indications as well as to the intrinsic error.

2.4.3 *Intrinsic Error* — The error determined when the output power meter is under reference conditions.

2.4.4 *Absolute Error* — The measured or indicated value of a quantity minus the true value (that is, the exact value of the quantity that is being measured) expressed algebraically.

2.4.5 *Relative Error* — The ratio of the absolute error to the true value of the quantity that is being measured.

2.4.6 *Variation in Indication* — The difference between the measured values of a power, when an influence quantity assumes successively two specified values.

2.4.7 *Maximum Variation in Indication* — The maximum difference between the measured values of a power when an influence quantity assumes all the values between specified limits.

2.4.8 *Percent Error* — The relative error expressed as a percentage of the maximum value of effective range.

2.5 Influence Quantities and Reference Conditions

2.5.1 *Influence Quantity* — One of the quantities like temperature, external magnetic field, etc, which affects the indications of the output power meter but which is not the one measured by it.

2.5.2 *Reference Conditions* — The whole of the specified conditions under which the output power meter meets the requirements concerning the intrinsic errors. These conditions determine the reference values or reference ranges for influence quantities.

2.5.3 *Reference Value* — The value of an influence quantity at which the output power meter complies with the requirements concerning intrinsic errors.

2.5.4 *Reference Range* — A range of values of an influence quantity within which the output power meter complies with the requirements concerning intrinsic errors.

2.5.5 *Nominal Range of Use* — A range of values (generally assigned by the manufacturer) which any of the influence quantities may assume without the variation in indication of output power meter exceeding the limits specified.

2.6 Controls

2.6.1 *Mechanical Zero* — The equilibrium position of the moving element [shown by the index (pointer) on the scales] when no power is applied between the input terminals and with the output power meter in the nominal operating position.

2.6.2 *Zero Adjuster* — The mechanism by means of which the output power meter may be adjusted so that the mechanical zero coincides with the appropriate mark.

2.7 Miscellaneous

2.7.1 *Type Tests* — Tests carried out to prove conformity with the requirements of this standard. These tests are intended to prove general quality and design of a given type of output power meter.

2.7.2 *Acceptance Tests* — Tests carried out on samples selected from a lot for the purpose of performing the acceptance of the lot.

2.7.2.1 *Lot* — All output power meters of the same type, category and rating manufactured by the same factory during the same period using the same process and materials.

2.7.3 *Routing Tests* — Tests carried out on each output power meter the requirements which are likely to vary during production.

3. GENERAL REQUIREMENTS

3.1 The audio frequency output power meter shall be constructed of materials and components most suitable for the purpose or use. The instrument shall be self-contained except for the associated tests leads, prods and clips. No other external accessory shall be necessary for the measurement in any of the specified self-contained ranges of the instruments. However, extra accessories may be required for the extension of the measurement ranges.

3.2 Components — The components, such as resistors, capacitors and inductors, used in the power meter shall conform to the relevant Indian Standards wherever available.

3.3 Normal Position of Use — The normal position of use of the output power meter shall be either with the dial in the vertical plane or inclined at 30° to the vertical unless otherwise specified.

4. CONSTRUCTIONAL REQUIREMENTS

4.1 Indicating Instruments — The indicating meter shall be mounted on the front panel of the output power meter.

4.1.1 *Scale*

4.1.1.1 *Scale division* — The value of each scale division shall be either 1, 2 or 5 of the units measured or any decimal multiple or sub-miltiple of these numbers.

4.1.1.2 *Figuring and scale numbering* — Scales shall, in general, be figured at suitable long or medium scale marks, but not at both, except that the scale-end marks may be figured irrespective of their length. The digits shall be of such a shape as to minimize the risk of different digits being confused with one another and shall be so spaced as to render individual groups clearly distinguishable from adjacent groups Where necessary, for this purpose, the noughts may be reduced in size. The unit of scale number shall be so chosen that the numerals (hole number or decimal marked on the dial) shall not have more than three digits.

4.1.1.3 *Direction of deflection* — The direction of the scale corresponds to the positive increasing values of the scale numbering. The normal direction is fixed from left to right or from bottom to top. When the angular deflection of the index exceeds 180°, the direction of the increasing values of the scale numbering shall be clock-wise. On multiple-scaled instruments, at least one of the scales shall be in the normal direction.

4.1.1.4 *Width of scale division* — The width of the scale division within the effective range shall be not less than 0·8 mm measured along the centre of the shortest scale marks when the output power meter is provided with a knife-edge pointer and anti-parallax mirror. For other instruments, the width of scale division with the effective range shall be not less than 1·2 mm.

4.1.1.5 *Construction of scale* — Scale shall consist of long or medium or both and short scale marks. The scale divisions shall be consistent with the requirements of **4.1.1.4**. The medium scale mark shall be not less than 1·3 times or more than 1·5 times the length of the short scale mark. Long scale mark shall be not less than 1·7 times or more than 2·0 times the length

of the short scale mark. The thickness of the short scale mark shall not differ noticeably from the thickness of that portion of the index which moves over the scale marks. In the case of those output power meter which are intended to be read from a distance, numbers and other salient marks may be thickened.

4.1.2 *Index (Pointer)*

4.1.2.1 The pointer shall be light and rigid and so shaped as to lend itself to easy and accurate reading.

4.1.2.2 The pointer shall be insulated from the electric circuit of the output power meter unless the scale plate, is at substantailly the same potential as the pointer and is insulated from the case.

4.1.2.3 In any output power meter not provided with means for avoiding errors of reading due to parallax, the clearance between the scale and the portion of the pointer which traverses it, shall be not more than the portion of the pointer which traverses it, shall be not more than 1·5 mm or 1/100 of the length of the scale whichever is greater.

4.1.2.4 Except for output power meters with platform scales, the length of a pointer other than knife-edge pointer shall be such that the tip exceeds over more than one-third, but not over more than two-thirds of the lengths of the shortest scale-mark.

4.1.2.5 A knife-edge pointer shall extend over the whole length of the short scale marks but not appreciably beyond them.

4.1.2.6 The thickness of the pointer knife-edge shall not exceed 0·2 mm.

4.1.2.7 For an output power meter fitted with an anti-parallax mirror, the knife-edge of the pointer shall be coloured red on the top-edge.

4.1.3 *Limits of Effective Range* — When the effective range does not correspond to the total scale length, the limits of the effective range shall be marked on the scale. It is, however, unnecessary to mark the limits of the effective range when the value of the scale division or the nature of the scale marks enable the range to be identified without ambiguity.

4.1.3.1 The ratings shall preferably be chosen from the basic series 1, 10 and 10 or their decimal multiples or sub multiples for the indication of the power (both for direct and dBm indications).

4.2 Terminals and Connectors — The types of connectors and terminals provided shall be clearly indicated. If so required for the correct use of the output power meter, the terminals shall be clearly marked to show the proper method of connection.

4.2.1 The terminals may be either of screwed type or of socket type and shall be suitably insulated. If the terminals are of the screwed type, the head shall be non-detachable. The terminals shall be designed to provide shock-proof contacts with the test lead-ends. The terminals shall be located sufficiently apart so that easy connection with the test leads is facilitated.

4.2.2 Spring washers and lock nuts or similar devices should preferably be used for fixing the binding parts to ensure that they do not become loose in use.

4.3 Overload Protection — The instrument shall have a suitable overload protection. The overload protection shall be effective on all the ratings of the instrument. The resetting control when provided shall be easily accessible and it shall not restore unless reset manually.

4.4 Earthing — The instrument having metal casing shall have provision for distinct connections to earth as follows:

Voltage of Circuit in Which the Instrument is Used	*Number of Connections to Earth*
V	
250 and below	1
Above 250	2

These terminals shall be provided over and above all other means provided for securing the output power meter and the metallic enclosure of current carrying cables.

4.4.1 The earthing terminals shall be readily accessible and so placed that the earth connection of the instrument is maintained when the core or any other movable part is moved.

4.4.2 The earthing terminals shall be of adequate size, be protected against corrosion and shall be metallically clean. Under no circumstances shall a movable metal part of the enclosure be insulated from the part carrying the earthing terminals when the movable part is in place.

4.4.3 The earthing terminal shall be identified by means of a sign marked in a legible and indelible manner on or adjacent to the terminals.

4.5 Workmanship and Finish

4.5.1 All parts shall be manufactured and assembled in accordance with the current engineering practice. The output power meter shall be so assembled as to prevent ingress of dust and other particles.

4.5.2 *Finish* — All exposed metal parts shall be painted or otherwise protected to prevent corrosion under normal conditions of use.

5. CONTROLS AND ADJUSTMENTS

5.1 The controls and adjustments, if any, shall be provided on the front panel of the output power meter.

5.2 Mechanical Zero Adjustment — The range of mechanical zero adjustment, if any, when provided, shall not exceed 6 percent of the scale length. The ratio of the amplitude of the adjustment on either side of zero shall not be greater than 2.

6. EXTERNAL ACCESSORIES

6.1 Test Leads, Prods and Clips — The length of each test lead shall be not less than one metre. The test lead shall be single core unkinkable flexible conductor, suitable for measurement of the magnitude of the quantity involved [*see* IS : 1554 (Part I)-1964*]. The test leads shall be adequately protected at the ends to withstand strain in normal use. The test leads shall be coloured red and black.

6.1.1 The test prods shall be suitably insulated and shall have pointed ends. They shall also be coloured red and black.

6.1.2 The test clips shall be capable of being fitted to the test leads in place of the test prods.

6.1.3 The contact parts of test prods and clips shall be given a rustproof metal coating (*see* IS : 1068-1958†).

6.2 Carrying Case — A suitable carrying case, designed fragile parts of the output power meter shall be provided if required by the purchaser. It shall also accomodate all the accessories.

7. CHARACTERISTICS OF AUDIO FREQUENCY OUTPUT POWER METER

7.1 Basic Characteristics — Table 1 specifies the basic characteristics and the minimum values for the same. Reference to appropriate methods of tests described in Appendix A also has been made in the Table.

*Specification for PVC insulated (heavy duty) electric cables: Part I For working voltages up to and including 1100 volts.

†Specification for electroplated coatings of nickel and chromium on iron and steel.

TABLE 1 PERFORMANCE LIMIT OF BASIC CHARACTERISTICS

(*Clause* 7.1)

Sl No.	Characteristic	Performance Limit	Test Method (Ref to Clause in Appendix A)
(1)	(2)	(3)	(4)
i)	Intrinsic error of power rating	5 percent	A-1
ii)	Power ranges	1 mW full scale deflection to 100 W full scale deflection in suitable overlapping steps, the minimum overlap being 4·0 percent of the maximum reading of the previous scale	A-2
iii)	Impedance range (*see* Note)	2 ohms to 600 ohms in suitable steps with an accuracy of 5 percent	A-3
iv)	Frequency response	5 percent between 50 Hz and 20 kHz	A-4

Note — The reactive component of the input impedance should be low compared to the resistive component of the input.

7.1.1 Table 2 specifies reference conditions of influence quantities.

7.2 Other Characteristics

7.2.1 *Variation in Indication* — The permissible variation in indication shall be as specified in Table 3 for various conditions.

7.2.1.1 The determination of variations in indication associated with the influence quantities is listed in Table 4.

7.2.2 *Damping* — The damping of the instrument characterized by its overshoot and settling time shall be measured in accordance with **A-12** and shall meet the following requirements:

a) *Overshoot* — Under the test conditions, the overshoot shall not exceed the upper limit of effective range.

b) *Settling time* — Under the test conditions the time required for the index to attain its final steady position within 1·5 percent of the upper limit of the effective range shall not exceed 4 seconds.

7.2.3 *Errors Due to Overload*

7.2.3.1 When subjected to the continuous overload test in accordance with **A-13**, the instrument shall comply with the requirements of its specified intrinsic error.

TABLE 2 REFERENCE CONDITION OF INFLUENCE QUANTITIES

(*Clause* 7.1.1)

Sl No.	Influence Quantity	Reference Condition		Tolerance Permitted Above the Reference Value
		When Marked	In the Absence of Marking	
(1)	(2)	(3)	(4)	(5)
i)	Ambient temperature	Reference temperature or any temperature within the reference range	27°C	±1°C
ii)	RH	Reference RH	65 percent	±2 percent
iii)	Position	Reference position	Any position	±1°
iv)	External magnetic field	Total absence of external magnetic field	Total absence of external magnetic field	Value of induction of vertical magnetic field
v)	External electric field	Total absence of electric field	Total absence of electric field	Under consideration
vi)	External RF Emf	Total absence	Total absence	Under consideration

TABLE 3 PERMISSIBLE VARIATION IN INDICATION

(*Clause* 7.2.1)

Sl No.	Condition	Permissible Variation	Test Method Ref to Clause in Appendix
(1)	(2)	(3)	(4)
i)	Influence of position	±5%	A-5
ii)	Influence of ambient temperature	*	A-6
iii)	Influence of external magnetic field:		A-7
	a) When specified by the manufacturer	±5%	
	b) At 5/10th of millitesla (when not specified by the manufacturer)	±0·3%	
iv)	Influence of external electric field	Under consideration	A-8
v)	Influence of external RF electromagnetic field	Under consideration	A-9
vi)	Fluctuation (random and spurious variation)	2·5%	A-10
vii)	Drift	2·5%	A-11

*The operating temperature range should be 10 to 40°C.

TABLE 4 NOMINAL VALUES OF THE LIMITS OF THE NOMINAL RANGE OF USE

(*Clause* 7.2.1.1)

Sl No.	Influence Quantity	Limits of Nominal Range of Use
(1)	(2)	(3)
i)	Ambient temperature	10 to 40°C in stops of 10°C
ii)	Position	Reference position ±5°
iii)	External magnetic induction	0·5 mT (*see* Note)
iv)	External electric field	Under consideration
v)	Influence of external RF electromagnetic field	Under consideration

Note — 400 ampere-turns will produce a field of approximately 0·5 mT or near the centre of plane circular coil 1 m in diameter.

7.2.3.2 When subjected the test overload for short duration in accordance with **A-14**, the instrument shall comply with the requirements of its specified intrinsic error.

7.2.4 *Type of Input* — The type of input should be single ended. Other types of input, such as symmetrical or differential may be provided.

7.3 Insulation Resistance and High Voltage

7.3.1 *Insulation Resistance* — The insulation resistance shall be measured between two terminals connected together and the body or case of the instrument at 500 ± 50 V dc after electrification for a period of 1 minute. Insulation resistance shall be not less than 100 megohms.

NOTE — This test shall be carried out under the prevalent ambient temperature.

7.3.2 *High Voltage* — When a voltage of 1 000 Vrms is applied across the two terminals connected together and the body or case for a period of 1 minute, no breakdown, arcing or sparking shall occur.

NOTE — This test shall be carried out under the prevalent ambient temperature.

8. MARKING

8.1 The unit of the measured quantity (power) shall be marked clearly on each of the instrument on the scale plate of its indicating meter.

8.2 The following markings shall be indicated on each of the instrument on one of its external surfaces preferably on the front panel:

a) Accuracy;
b) Rating in terms of the measured power;
c) Impedance range and accuracy;
d) Indication of the reference position;
e) Manufacturer's name and trade-mark;
f) The designation, type, and serial number;
g) Nominal range of frequency of the measured power; and
h) A suitable symbol to show that some other essential information is given in technical document (*see* **9**).

8.2.1 The instrument may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

9. TECHNICAL DOCUMENTATION TO BE SUPPLIED BY THE MANUFACTURER

9.1 A technical document shall be supplied by the manufacturer with each instrument. This shall be prepared in accordance with IS : 6756-1972*. All the information given in **8** and relevant details of those given in **8.2** shall be repeated and more fully described in technical document together with the following:

a) Value of the induction due to the magnetic field of external origin for which the specified accuracy holds good,

b) Reference values or ranges of all influence quantities,

c) Nominal ranges of use,

d) Storage conditions, and

e) Transport conditions.

APPENDIX A

(*Clause* 7.1)

TEST METHODS

A-0. GENERAL CONDITIONS FOR MEASUREMENTS

A-0.1 Unless otherwise specified, measurements shall be made under normal measuring conditions as specified in **A-0.2** to **A-0.5**.

A-0.2 Standard Atmospheric Conditions for Tests

A-0.2.1 These tests shall be conducted at a temperature of 27 ± 1°C and relative humidity of 65 ± 2 percent (*see* IS : 196-1955†), unless otherwise specified.

A-0.2.2 The instrument shall be protected from draughts and direct radiations.

A-0.3 Measurements

A-0.3.1 All measurements shall be made under the conditions mentioned in each clause.

*Technical documentation to be supplied with electronic measuring instrument.
†Atmospheric conditions for testing (*revised*).

A-0.3.2 *Preliminary Adjustment* — The index of the instrument having a mechanical zero shall be set to the appropriate mark on its scale. All the preliminary adjustments specified by the manufacturer shall be carried out. In marking measurements, the mechanical zero shall not be altered.

A-0.3.3 Unless otherwise specified in the relevant clauses, all measurements shall be carried out within the measuring range.

A-0.4 Accuracy of Test Instruments — The test instruments employed to carry out measurements in accordance with this standard shall have an accuracy of at least one order higher than that specified for the quantity under measurement.

A-0.5 Reporting — The test report should clearly indicate the following:

a) Atmospheric conditions under which tests are carried out, and
b) Accuracy of test instruments.

A-1. ACCURACY

A-1.1 Accuracy of Power Ranges

A-1.1.1 The accuracy of different power ranges of the instrument shall be measured at 1 kHz at least at three points, say at 20, 50 and 100 percent of the effective range on each power range.

A-1.1.2 The AF power from a stable AF generator shall be fed to the audio frequency power meter through a non-inductive resistance equal to the impedance setting of the power meter. The voltage of the audio frequency signal generator shall be measured through an accurate electronic voltmeter (*see* Fig 1 for a typical set-up).

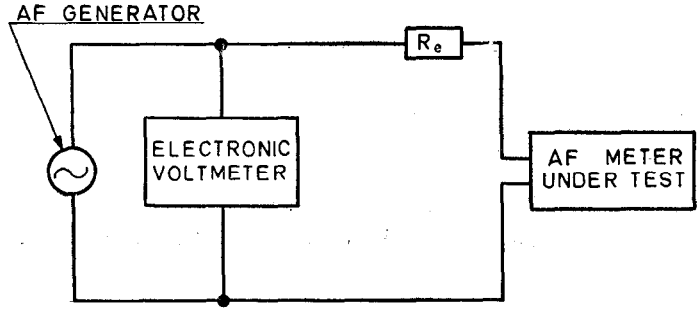


FIG. 1 SET-UP FOR MEASURING THE POWER RANGES AND THEIR ACCURACY

A-1.1.2.1 The input power shall be so adjusted that the desired deflection in a particular range is obtained on the power meter. The corresponding reading on the electronic voltmeter shall also be measured. If V is the voltage injected and measured by the electronic voltmeter, the actual power input to the audio frequency meter is equal to $\frac{V^2}{4R_e}$

A-1.1.3 From these measurements, the accuracy of audio frequency power meter under test shall be computed for each power range.

A-2. POWER RANGES

A-2.1 The power ranges shall be checked along with measurement of accuracy as given in **A-1**.

A-3. INPUT IMPEDANCE

A-3.1 The input impedance shall be measured at 1 kHz. The measurement may be made using a bridge circuit as given in Fig 2.

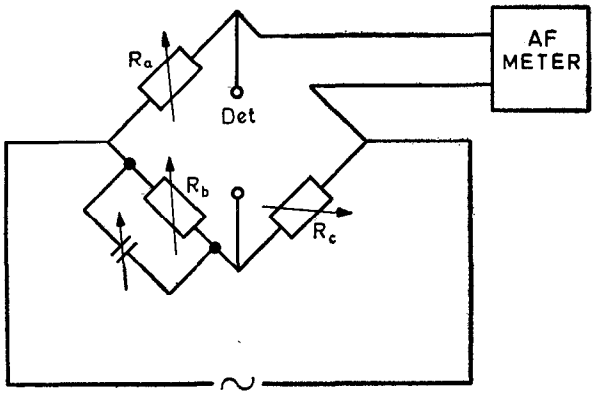


FIG. 2 SET-UP FOR MEASURING THE INPUT IMPEDANCE

A-3.1.1 The audio frequency output power meter under test shall be connected as the fourth arm of bridge and its impedance value shall be set at one of the calibrated points. The bridge shall be balanced to null indication by varying R_a, R_b and R_c. R_b may be shunted by a variable capacitance which may be adjusted to phase balance any reactive component which may be present in the impedance of the audio frequency output power meter. Then the actual impedance $= \frac{R_a \times R_c}{R_b}$

A-3.1.2 From these measurements, the impedance at each setting shall be computed and its accuracy determined.

A-4. FREQUENCY CHARACTERISTICS

A-4.1 Frequency Response — The frequency response measurements shall be carried out using the same set-up as given in Fig. 1. The input to the instrument shall be kept constant for a reasonable deflection, say 70 percent of the full scale deflection. The frequency of the signal generator shall be varied over the specified frequency range. The input to the audio frequency output power meter shall be accurately determined. The response, namely deflection versus frequency over the specified frequency range shall be obtained with respect to the value at 1 kHz.

A-5. INFLUENCE OF POSITION

A-5.1 The influence of the position shall be determined for only one of the ratings. After preliminary adjustments, a power corresponding to a steady deflection equal to 70 percent of the effective range and at 1 kHz shall be applied between the input terminals. With the instrument in reference conditions and also inclined to its reference position by an angle of $\pm 5°$ in two perpendicular planes successively, the reading of the index shall be noted. When several reference positions are indicated, the instrument shall be tested in each of these positions. When no reference position is indicated, measurement shall be made with the instrument in the normal operating position and also in a position perpendicular to this operating position.

A-5.1.1 From these measurements the variation in indication shall be computed.

A-6. INFLUENCE OF AMBIENT TEMPERATURE CHANGE

A-6.1 The influence of ambient temperature on the indications of the instruments shall be determined from measurements made at intervals of $10 \pm 1°C$ within the nominal range of 10 to 40°C, unless otherwise specified.

A-6.1.1 After the preliminary adjustments, a power corresponding to a steady deflection equal to 70 percent of the effective range shall be applied between the input terminals, the instrument being under reference conditions. The temperature shall be varied in steps of 10°C and the variation in indication shall be measured at each step after thermal equilibrium is reached at that temperature. From these measurements, the total variation over the specified temperature range shall be computed.

A-7. INFLUENCE OF EXTERNAL MAGNETIC FIELD

A-7.1 The test shall be carried out with magnetic field produced by direct current.

A-7.1.1 The instrument shall be placed in the centre of a circular coil of one metre mean diameter and of equal length, and of radial thickness small compared with the diameter.

A-7.1.2 The total current in the test coil shall be so chosen that in the absence of the instrument under test a magnetic field is produced, the induction of which has a value as specified by the manufacturer or 0·5 mT when not specified by the manufacturer.

A-7.1.3 The instrument having any maximum external dimension exceeding 25 cm shall be tested in a coil of mean diameter not less than four times the maximum dimension of the instrument and the current shall be so chosen as to obtain in the centre of the coil a magnetic field the induction of which is as specified in **A-7.1.1.**

A-8. INFLUENCE OF EXTERNAL ELECTRIC FIELD — Under consideration.

A-9. INFLUENCE OF EXTERNAL RF ELECTROMAGNETIC FIELD — Under consideration.

A-10. FLUCTUATIONS

A-10.1 After the preliminary adjustment, a power corresponding to a steady deflection equal to 70 percent of the effective range and at 1 kHz shall be applied between the input terminals. The fluctuations of the index (pointer) (the random and spurious deviations) shall be observed during one minute period over a specified interval. This shall be at least 15 minutes for ranges for 10 mW or less and one hour for other ranges. The maximum fluctuation occurring during any one minute period shall be noted.

A-10.2 The fluctuations shall be measured for each range.

A-11. DRIFT

A-11.1 After preliminary adjustments, a power corresponding to a steady deflection equal to 70 percent of the effective range shall be applied between the input terminals. The maximum deviation of the index (pointer) from the nominal value shall be observed during the time intervals specified by the manufacturer. This shall be at least 15 minutes for ranges of 10 mW or less one hour for other ranges. Maximum value of the drift shall be noted.

A-11.1.1 The drift shall be measured for each range.

A-12. DAMPING

A-12.1 The damping of the instrument is determined by the measurements of the overshoot and settling time.

A-12.1.1 After preliminary adjustments, a low frequency power corresponding to a steady deflection equal to 70 percent of the upper limit of the effective range shall then be suddenly applied between the input terminals. Under these conditions, the overshoot shall not exceed the upper limit of the effective range. The time required for the index to attain its final steady position, within 1·5 percent of the upper limit of the effective range, shall be measured.

A-13. ERRORS DUE TO OVERLOAD

A-13.1 Continuous Overload — An input power of 1·2 times rating shall be applied for two hours at the end of which the AF power meter should comply with the requirements of its intrinsic error.

A-14. OVERLOADS OF SHORT DURATION

A-14.1 An input power of four times the rating shall be applied five times with 15 seconds interval, the application time for each overload being as short as possible provided that the deflection of index should substantially exceed the upper limit of the effective range. At the end of this test, AF power meter should comply with the requirements of its specified accuracy.

(*Continued from page* 2)

Electronic Measuring Equipment Subcommittee, LTDC 4 : 2

Convener	*Representing*
SHRI C. S. RANGAN	National Aeronautical Laboratory (CSIR), Bangalore
Members	
SHRI M. T. SRIVASTSA (*Alternate* to Shri C. S. Rangan)	
SHRI S. BALASUBRAMANIAM	Philips India Ltd, Bombay
COL R. C. DHINGRA	Directorate General of Inspection (DGI) (Chief Inspectorate of Electronics) (Ministry of Defence)
SHRI N. GANESAN	Associated Instrument Manufacturers' (India) Pvt Ltd, New Delhi
SHRI D. PAHWA (*Alternate*)	
SHRI P. K. MANTRI	Toshniwal Bros Pvt Ltd, Ajmer
SHRI G. SUBBA RAO (*Alternate*)	
SHRI M. N. MATHUR	Telecommunication Research Centre (P & T Board)
SHRI J. S. MONGA	Radiola Corporation, New Delhi
MAJ K. N. PANDIT	Ministry of Defence (EME)
SHRI D. V. PETKAR	Bhabha Atomic Research Centre, Bombay
SHRI D. V. S. RAJU	ELICO Pvt Ltd, Hyderabad
SHRI S. RANGARAJAN	Bharat Electronics Ltd, Bangalore
REPRESENTATIVE	National Physical Laboratory (CSIR), New Delhi
RESEARCH ENGINEER	Directorate General of All India Radio, New Delhi
SHRI G. C. SAXENA	Electronics Corporation of India Ltd, Hyderabad

INDIAN STANDARDS

ON

ELECTRONIC MEASURING EQUIPMENT

IS:

2320-1963 Methods of measurements for amplitude modulated radio frequency signal generators (30 kc/s to 30 Mc/s)

2321-1963 Requirements for general purpose amplitude modulated radio frequency signal generators (30 kc/s to 30 Mc/s)

2711-1966 Direct reading *p*H meters (*revised*)

3437-1966 General requirements for direct reading pointer indicator type electronic voltmeter (*first revision*)

3886-1966 Minimum requirements for general purpose audio frequency signal generators (30 c/s to 30 kc/s)

3915-1966 Methods of measurements on audio frequency signal generators (30 c/s to 30 kc/s)

4309-1967 Methods of measurements on direct reading *p*H meters

4330-1967 Methods of measurements on cathode-ray oscilloscope (dc to 10 Mc/s)

6700-1972 Requirements for general purpose cathode-ray oscilloscope

6756-1972 Technical documentation to be supplied with electronic measuring equipment

6767 (Part I)-1972 Direct reading pointer indicator type ac/dc electronic voltmeter: Part I Methods of measurements

6767 (Part II)-1972 Direct reading pointer indicator type ac/dc electronic voltmeter: Part II Up to 30 MHz

6767 (Part III)-1972 Direct reading pointer indicator type ac/dc electronic voltmeter: Part III Up to 300 MHz

6769 (Part I)-1972 Direct reading pointer indicator type ac electronic millivoltmeter: Part I Methods of measurements

6769 (Part II)-1972 Direct reading pointer indicator type ac electronic millivoltmeter: Part II With a frequency range of 2 Hz to 1 MHz

6804-1972 Glass electrodes for direct reading *p*H meters

8290-1976 General purpose audio frequency output power meters

PUBLICATIONS OF INDIAN STANDARDS INSTITUTION

INDIAN STANDARDS

Over 9 000 Indian Standards covering various subjects have been issued so far. Of these, the standards belonging to the Electronics and Telecommunication group fall under the following categories:

- Acoustics and acoustic measurements
- Capacitors and resistors
- Electromagnetic interference and suppression
- Electromechanical components
- Electron tubes
- Electronic measuring equipment
- Environmental testing procedures
- Magnetic components and ferrite materials
- Microwave components and accessories
- Piezoelectric devices
- Printed circuits
- Recording
- Reliability
- Radio communication
- Semiconductor devices and integrated circuits
- Transformers and inductors
- Wire and cables

OTHER PUBLICATIONS

ISI Bulletin (Published Every Month)	
Single Copy	Rs 4·00
Annual Subscription	Rs 36·00
Standards : Monthly Additions	
Single Copy	Re 0·30
Annual Subscription	Rs 3·00
Annual Reports (from 1948-49 Onwards)	Rs 2·00 to 6·00
ISI Handbook, 1975	Rs 30·00

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephone : 27 01 31 (20 lines) **Telegrams : Manaksanstha**

Regional Offices:

		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	23-08 02
Southern : C. I. T. Campus, Adyar	MADRAS 600020	41 24 42

Branch Offices:

'Pushpak', Nurmohamed Sheikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narsimharaja Square	BANGALORE 560002	2 76 49
Ahimsa Bldg, SCO 82-83, Sector 17C	CHANDIGARH 160017	2 83 20
5-8-56/57 L. N. Gupta Marg	HYDERABAD 500001	4 57 11
117/418 B Sarvodaya Nagar	KANPUR 208005	82 72
B. C. I. Bldg (3rd Floor), Gandhi Maidan East	PATNA 800004	5 36 55
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27

Printed at New India Printing Press, Khurja, India